

Asexual Reproduction in Sea Cucumbers

by Jeffrey H. Simonson

Though all echinoderms reproduce sexually, some are known to reproduce asexually by means of fission. The sea cucumber *Holothuria parvula* is one of a very few number of these fissiparous species. Emson and Mladenov (1987) studied a large Bermudan population of *H. parvula*. They wanted to determine the extent of fission and its seasonal variation. In addition, they wanted to know if these sea cucumbers also reproduce sexually and if the two forms of propagation are related.

Emson and Mladenov also asked questions about the process of regeneration following the fission event. Is the regeneration of either half equally likely? What is the regeneration rate? And, how are the internal structures recreated?

The sea cucumber population in Bermuda was sampled over a 13 month period. Samples of 30 individuals were collected at 2 month intervals. From these, Emson and Mladenov determined the state of internal regeneration, the status of sexual maturity, and whether the animal was producing a new oral end or a new anal end.

H. parvula splits into two equal halves during fission, then regenerates the missing parts. The oral half must recreate practically all of the viscera and a new anus. Conversely, while the anal half regenerates only a small portion of the gut, it must replace feeding tentacles, the nervous system, and the water vascular system. Both halves lack critical parts and neither can feed immediately. Since feeding is the main priority, regeneration of the missing gut or feeding tentacles happens quickly. *H. parvula* are able to feed again in about 2 months. Despite these major differences in regeneration strategies, neither half showed a differential in survival rate.

Fission occurs in *H. parvula* during the summer when the water temperature is over 25°C; this may be a fission inducing environmental stress factor. A long period of regeneration follows through the autumn and winter. Rapid growth then proceeds into spring and early summer. Emson and Mladenov suggest these sea cucumbers can fully regenerate within a year and, since they found multiply fissioned individuals, be capable of annual fission.

Does this mean fissiparous echinoderms rely heavily on asexual reproduction? Emson and Mladenov found sexual activity was possible only in the summer, when fission was also occurring. In this Bermuda population, they found large gonads in recently split individuals. This implies sexual reproduction does not deter asexual reproduction. Furthermore, Emson and Mladenov suggest sexual maturation may make *H. parvula* susceptible to fission, which is then triggered by some environmental condition such as water temperature. Since no small individuals were found, it appears these sea cucumbers have not recently been reproducing sexually, but relying strictly on asexual fission to maintain the population.

Though many questions about asexual reproduction by fission in echinoderms still exist, it is probable *H. parvula* can maintain a viable population by fission. The existence of multiply fissioned individuals and the lack of small individuals suggest this recent reliance on fission. Further investigation may tell us why it happens. What environmental conditions cause one form of reproduction to be used over the other? How does fission actually work and what causes it to happen? This study has indeed created many intriguing questions.

Literature Cited

Emson, R.H., and P.V. Mladenov. 1987. Studies of fissiparous holothurian *Holothuria parvula* (Selenka) (Echinodermata:Holothuroidea). *J. Exp. Mar. Biol. Ecol.* 111:195-211.